MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

EEL2046 – ENERGY CONVERSION II

(LE)

24 FEB 2017
3:00 PM – 5.00 PM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question Paper consists of 3 pages including the cover page with 4 Questions only.

2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print your answers in the Answer Booklet provided.

Question 1

(a) With the aid of diagram explain the armature reaction? What are the effects on the operation of a DC Machine, and what are the solutions? [10 marks]

(b) A shunt generator machine has armature resistance of 0.18Ω driven at 1400 revolutions/minute. The magnetization characteristic of the shunt generator at 1400 revolution/minute is given by table 1.

Table 1

I_F in (A)	0	1	2	3	4	5	6
Emf in (V)	7	66	131	181	211	231	244

(i) Determine the critical field resistance for self-excitation. [3 marks]
(ii) What is the total field circuit resistance if the induced voltage is 236V. [3 marks]
(iii) What is the no-load voltage of the generator if the field circuit resistance is adjusted to 40Ω. [3 marks]
(iv) Assuming no Armature Reaction, determine the load current supplied by the generator if its terminal voltage is 210V and the field resistance is kept at the value computed in part (ii). [6 marks]

Question 2

(a) A Shunt DC Generator delivering output of 100kW at 230V has Armature resistance is 0.05 Ω and Field Resistance is 57.5Ω. It has a total mechanical and core loss of 1.8kW.
(i) Find the generator efficiency at full-load. [4 marks]
(ii) If generator speed is 3000 revolutions/minute, find the torque applied. [4 marks]

(b) A 4-pole DC shunt motor draws a current of 100A from a 220V DC supply. The field resistance is 110Ω. The armature resistance is 0.3 Ω.It runs at a speed of 1000 rpm. Draw the equivalent circuit and calculate the induced emf in the armature, the armature copper loss and field copper loss. [9 marks]

(c) A 240V shunt motor runs at 850 rpm when the armature current is 70A. The armature circuit resistance is 0.1Ω. Calculate the required resistance to be placed in series with the armature to reduce the speed to 650 rpm when the armature current is then 50A. [8 marks]

Continued...

Question 3

(a) A single phase induction motor unable to start itself. List down 5 ways a single-phase induction motor could start itself. Also draw the motor connection circuit for each method of start. [10 marks]

(b) A three-phase squirrel cage induction motor has a synchronous speed of 1800 rpm. It draws an input power of 100kW from a three phase supply. The stator copper and iron losses amount to 10kW.The windage and friction losses are equal to 4kW.If the motor runs at 1620rpm, calculate the following:

(i) the active power transmitted to the rotor [2 marks]
(ii) the slip [3 marks]
(iii) the rotor copper loss [2 marks]
(iv) the mechanical power developed [3 marks]
(v) the mechanical power delivered to the load [2 marks]
(vi) the efficiency [3 marks]

Question 4

(a) A 3-phase with 6 pole stator, stepper motor required for one particular application must be capable of stepping in 6° interval, and it must be capable of running at 600 rpm.

(i) How many rotor poles must this motor have? [4 marks]
(ii) How many pulses per second must be applied to the control circuit? [3 marks]

(b) Discuss the advantage and disadvantages of Brushless DC Motor applications. [8 marks]

(c) What is the purpose of a Single Phase Sychros Machine. Sketch a simple application circuit of a Single Phase Sychros Machine and explain its working principles. [10 marks]

End of Paper